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Eyepiece Views: March, 2002

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E Y E P I E C E V I E W S

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1. STARS THAT GO BUMP IN THE NIGHT

There is something special about watching the complete cycle of a star in one night. Besides a sense of closure, short period variables such as eclipsing binaries are perfect ways to introduce new people to variable star observing. You can build a complete light curve in one evening and explain to your friends what that "dip and bump" is. In one dose they get action and science, a perfect antidote to the short attention span syndrome of today's TV generation.

The AAVSO Eclipsing Binary and RR Lyrae Committee members and observers have worked dilligently and have effectively combined the strengths of visual and CCD observing into one comprehensive program. Their reward has been more than just a fun hobby, the committees have combined to publish 20 scientific papers and contributed to four books since the beginning of 2000. This does not include dozens of AAVSO publications such as the Eclipsing Binary Bulletin, Ephemerides, and Monographs.
If you are looking for something a little new to add to your VSO diet, consider EB's and RR Lyraes as short period snacks. But don't be fooled, you can get addicted and easily turn them into full meals! Remember, other stars need your appetite too.

Good observing!

Gamze Menali,AAVSO Technical Assistant (MGQ)
Aaron Price, AAVSO Technical Assistant (PAH)
Mike Simonsen, AAVSO Observer (SXN)

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2. COPING WITH LIGHT POLLUTION
By Gary Poyner (PYG)

It has often been said and written in magazines and books aimed at the amateur astronomer, that observing from a heavily light polluted site prohibits any useful observations made visually at the telescope. When words such as these are read, many budding enthusiasts who live in a city environment probably think twice before buying a telescope and progressing further into our fascinating hobby. Well nothing could be further from the truth! Here, I would like to relate to fellow AAVSO members the problems I have encountered over the years, and the variable star programme that I undertake every clear night.

I live in Birmingham, England - the UK's second largest city with a population in excess of two million, and a local catchment area of some seven million people. My home is around 5 miles north from the city centre which of course means one thing - heavy light pollution. On the Bortle Dark Sky scale (see S&T Feb 2001, and a scale which should become the standard for amateurs to use), my sky would be described as class 7. Below -10d declination, the sky is a deep orange. Quite apart from street-lighting, there is the problem of localised light pollution - security lights. City crime manifests itself into a plethora of lights, which are increasingly illuminating back gardens around the city. Of the immediate 40 properties surrounding my home, 34 have Passive Infrared security lighting in their backyard! Not the ideal place for setting up an observatory, or indeed for observing variable stars - or so one would think! Travelling to a dark sky from my location isn't really an option. The nearest (and only real dark skies in the UK) are to be found in mid-Wales, a pointless journey of 80+ miles to make considering our unstable climate. So with this seemingly far from ideal situation, how does one go about making the best of a bad situation, and what sort of stars can one expect to observe in these conditions?

My 18 inch f4.5 reflector is located in a small observatory at the bottom of the garden, which has been deliberately constructed to look like an ordinary garden shed. A dome would be like a magnet to intruders. The roof is hinged and open's up from the centre. This allows me to have one side open and the other closed, thus protecting me to a certain degree from stray light. One draw back with this design means that in high winds, the observatory has to be kept closed. In addition to the roof, I have also constructed several screens at strategic locations around the garden which again prevents stray light shining directly into the observatory. To the North, a high (9 foot) hedge gives similar protection. The one thing these preventative measures do not stop is of course the sky light pollution itself. I live on a busy main road, which means lots of street lighting too. This I have to live with.

My programme of variable stars consists of some 275+ CV's (Cataclysmic Variables) and eruptive stars, most of which are quite faint. I also observe AGN, and a few Mira stars - one's which I have been observing for many years and treat as old friends. To monitor many

of these stars efficiently, a magnitude of 15 or fainter is required. This may seem a daunting task from an observing site described above, but on the clearest of nights magnitude's below 16 have been recorded using accurate sequences drawn up Arne Henden and Bruce Sumner. These faint limits are achieved in several ways. Firstly the mirrors of my telescopes (I also have a portable 8.75 inch f6) are kept as clean as possible. This means washing every 6 months, and aluminising every 2 years or so. The mirrors are always dried after each observing session, and covered well. The quality of eyepiece is also very important. It has always amazed me to see very expensive telescopes used with average quality eyepieces. The difference between the two can mean as much as a single magnitude on occasions. As the majority of my observing is done under medium to high power, I use very high quality eyepieces. Finally there is no substitute for experience. I have been looking through telescopes of all types for the best part of 37 years, and this is undoubtedly a major factor in reaching faint magnitude levels in a light polluted site.

One of the great pleasures in observing faint CV's, is to follow eclipsing Dwarf Novae like DV UMa or IP Peg to a deep minimum (below mag. 16), or to see stars like KS UMa at minimum (16.2) or indeed faint outbursts in DI UMa (15.5). These things can be achieved from a city/urban site, providing a small amount of preperation and care is taken beforehand.

Don't despair if you haven't got an 18 inch reflector in your backyard. The 8.75 inch reflector will show me stars to magnitude 14.5 on clear nights, revealing many interesting CV's, eruptives etc.

So if you live in a city/urban area, would like to see how these enigmatic CV's behave and have access to a telescope, then don't confine your observing to the brightest binocular variables. Go outside and have a go. You might just be surprised what can be achieved with a little patience! Most of us suffer from light pollution, so why not make the best of a bad job and give it a try!

Some pictures of light pollution, garden screens etc. can be seen on the following web pages...
http://members.aol.com/GaryPoyner/varstars.html

Gary Poyner (PYG)

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3. AN INTRODUCTION TO SHORT PERIOD VARIABLES (EBs, and RR LYRAE's)
By Marv Baldwin, Chairman Eclipsing Binary & RR Lyrae Committees

For three and a half decades visual observers of the AAVSO eclipsing binary and the RR Lyrae programs, joined more recently by CCD observers, have been timing the minima and maxima of these stars for the purpose of tracking their period variations. Some of these stars seem to have rock solid periods showing no sign of change while others demonstrate frequent changes in period. Still others may maintain a stable period for a long period of time and then suddenly switch to a new period. We often joke that one of these stars will change its period the day after you publish it and establish a new ephemeris.

When we refer to one of these stars changing from one period to another we are not talking about changes of hours or even minutes .

We are dealing with changes of perhaps a second or fractions of a second. A typical eclipsing binary with a period of one day would be considered to have a substantial change in period if it differed by only one second. Nevertheless, if this star were closely monitored by visual observers the change would start becoming detectable within one year and there would be no doubt after two years. More accurate CCD observations could detect this change much earlier.

We normally expect visual observations of eclipsing binaries with short periods on the order of one day or less and with fairly deep eclipses to yield times of minima with an accuracy in the range of plus/minus five minutes. Measurement of the time of minimum (ToM) is not so much dependent on the observations made at minimum but is highly dependent upon the observations made on the steepest portions of the ascending and descending branches of the light curve. A typical faux pas committed by inexperienced observers is to decide that minimum has been reached once the curve bottoms out and stop taking data. Such data is worthless for the purpose of accurately measuring a ToM. Of course data of this sort can be very useful for newly discovered eclipsing binaries with unknown period and no ephemeris for prediction of minima.

For both eclipsing binaries and RR Lyrae variables visual observations should be made at roughly 10 minute intervals. As noted above the eclipsing binary data should cover both legs of the eclipse curve, usually one to two hours either side of the minimum, to obtain the steep portions of the light curve for accurate measurement of ToM. For the RR Lyrae stars observations should begin an hour or two before maximum and continue for about an hour after maximum appears to have been reached. An RR Lyrae star normally rises quickly from minimum to maximum (within an hour or two) and then slowly returns to minimum after many hours. The most definitive portion of the light curve occurs from minimum through maximum, and the observer should endeavor to catch the star before the rise from minimum begins. Measurement of the time of maximum for an RR Lyrae star is not as clearcut as the measurement of minimum for the eclipsing binaries because of the asymmetric nature of the RR Lyrae light curve. As a result, measurement of maxima timings with visual data is not as accurate. An argument could be made that CCD observations should be used for this purpose. Ahhhhh.... if only we had enough experienced CCD observers and they had time to do this work.

One might ask why all these period changes are taking place. If only we knew! Sometimes we can speculate on a few things.... perhaps a third object in the system..... transfer of mass from one star to another... some change in pulsation mode. Well, most of us are amateurs. We obtain the data and then go to the AAVSO meetings and listen to a professional do a scientific modeling of these systems..... a higher class form of speculation.

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4. THE ECLIPSING BINARY TEAM

By Marv Baldwin

A couple of years ago, following an article in Sky & Telescope about some eclipsing binary stars discovered by the Hipparcos satellite, we attempted to visually observe a number of these stars hoping to determine their periods. Our success in this effort has been limited.

However, the success we experienced with one of those variables, CD Lyn, set in motion a series of events involving a number of experienced observers. We could say that the enthusiasm generated by this successful cooperative effort by an aggregation of observers with diverse skills caused them to coalesce into an ad hoc crew which we now pridefully refer to at the "Eclipsing Binary Team".

In the case of CD Lyn visual observers caught the star in eclipse a few times and were soon able to predict future events. But the eclipses were shallow and we were not able to determine precise times of minima. CCD observers joined the effort, soon determined accurate times of minima, and obtained filtered data to add color and temperature information. Two other observers headed to the Harvard plate stacks and obtained the historical minima on this star providing the information needed to determine a highly accurate period.

A suggestion was made that perhaps a better source of newly discovered eclipsing binaries needing investigation would be those variables discovered by the Robotic Optical Transient Search Experiment (ROTSE). A list of about one hundred stars, tentatively identified as eclipsing binaries, was obtained from those files. We examined the data available for those stars and selected a few which seemed to offer potential for having visually observable minima. Our success rate has been most gratifing.

CCD observers are not inclined to sit on a star all night waiting for something to happen, but a visual observer can monitor as many as 20 of these stars throughout the night. It has been common to find as many as three stars entering eclipse in a single evening. Once two or three eclipses of a star are detected the search for a period can become serious. Often times tentative periods provided in the ROTSE files prove to be fairly accurate and in these cases the observation of a single eclipse can lead to the provisional determination of the next observable eclipse.

Once a reliable ephemeris for one of these stars is determined CCD observers join the effort to establish a precise light curve with various filters, historical data is obtained from the plate stacks, and if procrastination does not become a serious factor everything comes together resulting in another paper. "The Team" has published a considerable number of papers on these stars during the past 20 months. Most of these have been published in the Information Bulletin on Variable Stars. A listing of a few of these published papers accompany this article.

GSC 0983.1044: A SHORT-PERIOD RS CVn BINARY
IBVS# 5231 (2002)
http://www.konkoly.hu/cgi-bin/IBVS?5231

Light Elements and Light Curve of the Eclipsing Binary GSC 2605.0545
IBVS# 5229 (2002)
http://www.konkoly.hu/cgi-bin/IBVS?5229

Eclipsing Variable GSC 2084.0777 = ROTSE1 J174103.55+273429.1
IBVS# 5228 (2002)
http://www.konkoly.hu/cgi-bin/IBVS?5228

The Short-Period Eclipsing Binary GSC 3123.1618

IBVS #5029 (2001)
http://www.konkoly.hu/cgi-bin/IBVS?5029

Precision Light Elements and Light Curve for the Eclipsing Binary LD 355
IBVS #5018 (2001)
http://www.konkoly.hu/cgi-bin/IBVS?5018

Light Elements and a Preliminary Solution for the Light Curve of the Eclipsing Binary GSC 1534.0753
IBVS #4930 (2000)
http://www.konkoly.hu/cgi-bin/IBVS?4930

The Hipparcos Variable CD Lyncis
IBVS #4911 (2000)
http://www.konkoly.hu/cgi-bin/IBVS?4911

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5. NEW EB AND RR LYR CHARTS

For decades the majority of the eclipsing binary and RR Lyrae charts for AAVSO program stars had magnitudes that were assigned to their comparison stars without the benefit of adequate source information and many of the comp stars were simply assigned visual step values.

These charts were not in a computerized format, and therefore not available online. Paper copies had to be ordered and delivered by mail.

There are now standard and reverse charts for 98 EB and 40 RR Lyr stars. These charts are available online in the same format as all the new AAVSO variable star charts. The sequences have been derived form Tycho-2 (V) and USNO A2.0 (V) magnitudes, and in some cases from CCD(V) magnitudes.

Hopefully, readily available charts in a familiar format will encourage more observers to observe these interesting variable stars.

The charts can be accessed via the AAVSO FTP site (ftp.aavso.org) or via our online chart search engine at this URL:

http://charts.aavso.org/searchcharts.shtml

Visit the respective committee web pages for ephemerides, information on how to observe, and instructions on reporting observations (Note: they are not sent to AAVSO HQ).

http://www.aavso.org/committees/eb.stm
http://www.aavso.org/committees/rrlyrae/

As always, send comments to charts@aavso.org. Here are lists of the new charts.

Eclipsing Binaries: AB AND, RT AND, TW AND, WZ AND, XZ AND, OO AQL, V342 AQL, V343 AQL, V346 AQL, XZ AQL, CX AQR, RY AQR, WW AUR, ZZ BOO, AL CAM, SV CAM, Y CAM, RW CAP, AB CAS, RZ CAS, TV CAS, EG CEP, U CEP, XX CEP, SS CET, R CMA, UU CMA, U CRB, V CRT, RV CRV, W CRV, BR CYG, CG CYG, SW CYG, V346 CYG, V387 CYG, V477 CYG, WW CYG, Y CYG, ZZ CYG, FZ DEL, TT DEL, TY DEL, W DEL, YY DEL, AI DRA, TW DRA, Z DRA, YY ERI, OW GEM, RW GEM, CT HER, SZ HER, TU HER, AV HYA, CM LAC, SW LAC, VX LAC, Y

LEO, DELTA LIB, SS LIB, T LMI, EW LYR, FL LYR, BO MON, RU MON, RW MON, SX OPH, U OPH, EQ ORI, ER ORI, FL ORI, AQ PEG, TY PEG, U PEG, BETA PER, RT PER, RV PER, ST PER, XZ PER, Z PER, Y PSC, U SGE, V505 SGR, AC TAU, AM TAU, RW TAU, RS TRI, RV TRI, V TRI, X TRI, TX UMA, VV UMA, W UMA, XZ UMA, RU UMI, U PEG, BETA PER, RT PER, RV PER, ST PER, XZ PER, Z PER, Y PSC, U SGE, V505 SGR, AC TAU, AM TAU, RW TAU, RS TRI, RV TRI, V TRI, X TRI, TX UMA, VV UMA, W UMA, XZ UMA, RU UMI, AG VIR, BU VUL,

RR Lyrae: AT AND, SW AND, XX AND, SW AQR, BH AUR, TZ AUR, RS BOO, ST BOO, SW BOO, SZ BOO, TV BOO, TW BOO, UU BOO, UY BOO, RR CET, RW CNC, TT CNC, DM CYG, XZ CYG, RW DRA, XZ DRA, RR GEM, AR HER, DL HER, DY HER, TW HER, VX HER, DG HYA, DH HYA, SZ HYA, UU HYA, VX HYA, RR LEO, SS LEO, TV LEO, WW LEO, SZ LYN, RZ LYR, AV PEG, RV UMA

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6. OBSERVING ECLIPSING BINARIES, A BEGINNER'S PERSPECTIVE

By Mike Simonsen (SXN)

As part of the project creating new charts for EBs, it became necessary for me to observe and sky check the fields and sequences for many of these stars. I decided to try my hand at timing the minima of some of these stars as they faded and re-brightened. I hoped to learn first hand what the attraction was to observing these stars.

Just like any other observing program, the first step is to choose the stars you want to observe. My main criterion was to try stars that had fairly large amplitudes, two magnitudes or better, and were faint enough to be appropriate for observing with a 10" telescope. I figured that if I couldn't see a two magnitude change it was time to sell the telescope and take up another hobby.

My secondary considerations all involved sky checking the charts for one reason or another. In some cases, the position or identity of the variable was in question. In other cases, field stars were missing from the charts or galaxies were plotted as stars. These points and the sequences themselves needed to be addressed before releasing the charts.

After determining which stars I would observe I needed to figure out when to observe them. Unlike most other stars in the AAVSO program which you can observe at your convenience, once a month or once a night, observing these stars takes a bit of planning. You have to know when the eclipse is predicted to start, reach minimum, and end.

I downloaded the EB ephemeris from the AAVSO website and studied it. Left to right, on the top of the page, you find the star name, magnitude range and the duration of the eclipse rounded to the nearest hour. Top to bottom, are the double dates in UT, representing the nights of the month. In the body of the table you find the predicted times of minimum, rounded to the nearest half-hour. I found the easiest thing to do was use a highlighter to note my program stars on the page top to bottom, and then highlight the night I was going to observe across the page. At a glance, I could find the stars that would be in eclipse for that night and plan my session.

It's a good idea to find the field and familiarize yourself with the comparison stars well before the eclipse. These stars wait for no one. The eclipse will commence without you if you are still struggling to

find the field.

Another thing to take into consideration when planning for the session is how long the eclipse will last and how long the star will be observable before setting, or dropping behind some local obstruction at your observing site. It was rather disappointing to follow a star for several hours only to realize it was about to disappear behind a tree I hadn't taken into account.

I found the hardest part of observing these stars was determining when the eclipse had actually begun. A very subtle drop of a tenth magnitude or less is hard to detect with a great deal of certainty. Don't let your expectations influence what you see. Once the star had faded a tenth or more, it became pretty obvious, especially if I had studied the field and become familiar with it beforehand.

Some of the stars I chose to observe had dramatic eclipses of three or four magnitudes. These were especially remarkable to watch over the course of several hours. Eventually, I became comfortable enough to monitor several eclipses at once during a session.

I have discovered the intrigue and challenge of observing these stars, and will no doubt keep a few as regular members of my observing program.

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7. CVs and UNUSUAL OBJECTS FOR MARCH

By Mike Simonsen (SXN)

In keeping with the eclipsing theme of this issue, I would like to introduce some other stars which visual observers can observe eclipses of.

0103+59 HT Cas (UGSU+E) Although outbursts are rare, when this star does flare up eclipses on the order of 2 magnitudes can be observed. A short outburst was observed in early February, 2002. HT Cas didn't get much brighter than 13.6. When it goes into superoutburst it may get as bright as 10.8.

1804+67 EX Dra (UGSS+E) This star has frequent outbursts. Typically getting as bright as 13th magnitude, and sometimes brighter, eclipses of this system are around 1.5 magnitudes.

1859+16 V1413 Aql (ZAND+E) This is an eclipsing symbiotic system. Generally it hovers near 13th magnitude with occasional flare-ups to 11th magnitude. Every 434 days this system goes into eclipses that last around 70 days. It fades by approximately 2 magnitudes and then returns to its former brightness.

Long-term trends seem to indicate an overall fading of the system in recent years, making the eclipses more challenging to observe without larger aperture telescopes.

New charts are now online for this star at
http://www.aavso.org/charts/AQL/V1413_AQL/

For further information, Gary Poyner has an informative article online at
http://members.aol.com/PoynerGary/v1413aql_article.html

1934+30 EM Cyg (UGZ) This is a unique case of a UGZ type that exhibits eclipses. They are on the order of 1 magnitude and are short in duration, less than 20 minutes. This star is an interesting target because it can be followed throughout its range with modest sized telescopes and exhibits outbursts, standstills and eclipses, a very active star. It has the added bonus of residing in a very pretty star field in the Cygnus Milky Way.

2318+17 IP Peg (UGSS+E) Eclipses on the order of 1.5 magnitudes can be observed when this UG type goes into outburst. Although not always favorably placed in the sky, outbursts generally happen two or three times a year.

Some other eclipsing systems you may want to observe include DQ Her, U Gem and DV Uma.

Eclipse predictions, compliments of John Greaves, for these and many other CVs can be found at
http://members.aol.com/PoynerGary/eclip02.html

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8. HOW TO REPORT VARIABLE COMPARISON STARS

We have received many questions lately about comparison ("comp") stars that may be variable. It is very important that any suspected variability in comp stars be reported to HQ.

The first thing you need to do is check the AAVSO Validation File to see if the comp star has already been reported. (http://www.aavso.org/validation.stm)

Look for the designation of the main variable on the chart. Then look for comp stars listed around the variable. Comp stars will frequently have a similar designation but with a letter appended to the end. They also will have "comp" in the name of the star, a direction in respect to the main variable on the chart, and the comp star's value as printed on the chart. It is fairly simple to find a comp star. Here is an example of SS CYG comp stars in our Validation File:

```
2138+43   SS CYG
2138+43D  123 COMP N
2138+43E  113 COMP E
2138+43G  120 COMP W
2138+43I  84 COMP NE
2138+43K  80 COMP SE
```

Simply report the observation as you would any other variable star using the name and designation in the validation file. If, on the other hand, you do not find the comp star in the validation file then report it with the "9999+99" designation and make the name "XX COMP YY" where XX is the magnitude of the comp star as listed on the chart and YY is the general direction of the comp star in respect to the main variable on the chart. When we process the observations, 1-2 months later, the object will be added to the validation file.

It is very important to keep a close eye on comp stars because they have such a significant impact in the light curve of the star. If you notice anything strange please report it and do not use that comp star for making regular observations.

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9. CHART UPDATES

The AAVSO is constantly publishing new and revised variable star charts to make observing easier and more productive. The best way to stay on top of new charts is to visit our chart updates web page at this URL: http://charts.aavso.org/updates.stm

In addition to keeping this page updated, we are going to begin publishing a list of new and revised charts in every issue of Eyepiece Views. Please make a habit of either checking the web page or this list and update any charts you may be using.

New reversed & revised (minor cosmetic changes) charts from Jan 1 - Feb 28, 2002: V1413 AQL, V838 MON, HV VIR, RR AND, X PSC, U PSC, R PSC, T ARI, S LYN, R LYN, T CMI, ST GEM, U LMI, R COM, R AQR, IM NOR, W CAS, SS AUR, U LYN, UU AQL, HI AQL, WX CYG, Y CYG, RY AND, BG AND, DX AND, SV CAS, V705 CAS, WY CAS, R CET, RU CAP, V3443 SGR, BN ORI, V2540 OPH, SN 2002ap, SN 2002ao, RXSJ2329, DE CVN, plus the 138 EB and RR Lyr charts (see above).

For details on these new charts (changes, scales, etc.) visit the web page mentioned above. Please send any comments to charts@aavso.org.

EYEPIECE Views is published bimonthly and when circumstances warrant via e-mail. An archive is available at http://www.aavso.org/eyepieceviews/ . Please send comments and suggestions to gamze@aavso.org.

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The AAVSO has many free online publications including "CCD Views", a similar newsletter intended for ccd observers. To learn more and subscribe visit: http://www.aavso.org/mailinglists.stm

Good observing!

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